

NASA SBIR/STTR Technologies

S5.03-9646 - Multi-Sensor Ensemble Aerosol Assimilation - CERES, MODIS and VIIRS



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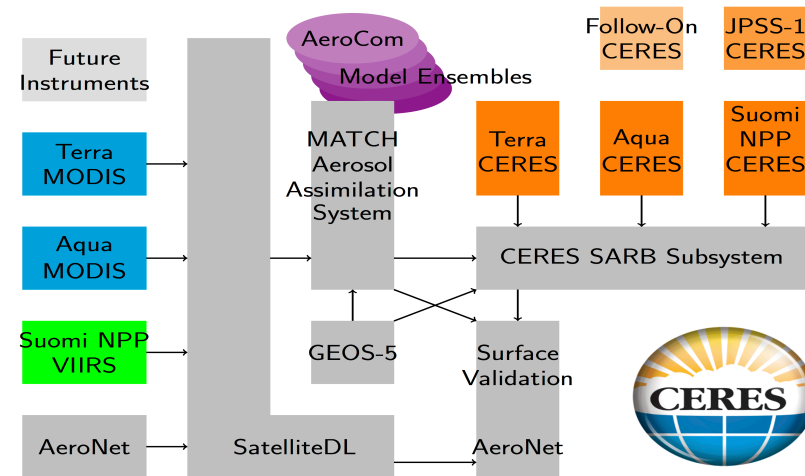
Identification and Significance of Innovation

Accurate estimates of the radiative effects of clouds and aerosols are essential for an understanding of the Earth's climate system. Under the EOS program, NASA has placed into orbit a series of satellites devoted to long term observations of the climate state. Central to the observation of the radiation balance are the CERES instruments that fly in tandem with a MODIS or VIIRS imager. The CERES mission depends on an aerosol assimilation system to augment information from MODIS-based aerosol inversions and allow for the creation of datasets such as surface radiative fluxes. This project will enhance the existing CERES aerosol assimilation system in several ways. We will extend the system to assimilate VIIRS and merged MODIS and VIIRS aerosol retrievals. We will prototype an ensemble Kalman filter aerosol assimilation system, which will allow for robust statistical uncertainty estimates in aerosol quantities of importance to the radiative forcing the climate.

Estimated TRL at beginning and end of contract: (Begin: 3 End: 5)

Technical Objectives and Work Plan

Objective I - Construct Multi-Sensor Aerosol Assimilation System
Task IA - VIIRS AOD Assimilation: Extend MATCH Assimilation System for VIIRS AOT EDR and VIIRS MODIS-like AOD.
Task IB - AeroNet Validation: Compare MODIS AOD 5.1, MODIS AOD 6, VIIRS AOT EDR based MATCH datasets versus AeroNet.
Objective II - Develop and Release SatelliteDL Toolkit
Task IIA - SatelliteDL Support for CERES, MODIS and VIIRS: Continue current work on CERES, MODIS and VIIRS L1 and L2 products.
Task IIB - Improved SatelliteDL Support for MODIS, VIIRS and AeroNet: Incorporate MODIS L3 products, VIIRS CDRs and AeroNet surface network.
Objective III - Prototype Ensemble Aerosol Assimilation System
Task IIIA - MODIS and VIIRS AOD Uncertainty Estimation: Construct MODIS and VIIRS AOD uncertainty models for MATCH, based on AeroNet statistics stratified by surface type.
Task IIIB - MATCH AeroCom Ensemble Generation: Parameter variations provided by AeroCom perturbation experiments.
Continue CERES and MATCH participation in AeroCom.
Task IIIC - Kalman Filter Tests and Computational Requirements: Prototype full Kalman filter aerosol assimilation with AOD uncertainty models (Task IIIA) and ensemble sets (Task IIIB).



NASA Applications

This project will directly support the generation of NASA CERES mission data products. It will provide continued MODIS-based aerosol analysis for the CERES Edition 4 surface flux datasets that are currently in production as well as VIIRS-based aerosols for post-MODIS and future CERES editions. Emphasis will be on data continuity between MODIS and VIIRS and the effect of the switch on the climate record. CERES instruments are presently in operation on the Terra, Aqua and Suomi NPP satellites.

Non-NASA Applications

CERES and VIIRS instruments are scheduled for launch on the NOAA JPSS-1 satellite in 2017, when CERES aerosol and flux products should be based primarily on VIIRS. The SatelliteDL software package and its multi-sensor cloud and aerosol datasets, as well as the ensemble aerosol analysis, will contribute to the international AeroCom collaboration.

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NON-PROPRIETARY DATA